

CLAIMS

1. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:
 - 5 a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in one control cycle of the pulse-width-modulation control and a time to output the voltage vector; - a voltage-vector adjusting unit that adjusts the time to output
10 the voltage vector in such a manner that a time to output a zero-voltage vector is ensured at least for a constant time; and
a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by
15 the voltage-vector adjusting unit.
2. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:
 - 20 a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in one control cycle of the pulse-width-modulation control and a time to output the voltage vector; - a voltage-vector adjusting unit that adjusts the time to output
25 the voltage vector in such a manner that

when a time to output a zero-voltage vector is longer than a predetermined time, the time to output the zero-voltage vector is ensured at least for a constant time, and

when the time to output the zero-voltage vector is shorter than the predetermined time, the time to output the zero-voltage vector is set to zero; and

a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

3. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:

a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in more than one control cycle of the pulse-width-modulation control and a time to output the voltage vector;

a voltage-vector adjusting unit that adjusts the time to output the voltage vector in more than one control cycle of the pulse-width-modulation control in such a manner that, when a total of a time to output a zero-voltage vector in more than one control cycle is shorter than a predetermined time, the time the output the zero-voltage vector between two adjacent cycles is set to zero and an amount of the time to output the zero-voltage vector between the two adjacent cycles

is distributed to the time to output the zero-voltage vector in control cycles next to the two adjacent cycles; and

a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

4. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:

a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in more than one control cycle of the pulse-width-modulation control and a time to output the voltage vector;

a voltage-vector adjusting unit that adjusts the time to output the voltage vector in more than one control cycle of the pulse-width-modulation control in such a manner that, when a total of a time to output a zero-voltage vector in more than one control cycle is shorter than a predetermined time, times to output same voltage vectors in more than one control cycle are added; and

a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

5. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:

- a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in one control cycle of the pulse-width-modulation control and a time to output the voltage vector;
- a voltage-vector adjusting unit that adjusts the time to output the voltage vector in such a manner that, when a time to output a zero-voltage vector is shorter than a predetermined value, upon receiving a voltage vector used for an adjustment in a previous control cycle, depending on whether a vector lastly output in the previous cycle is a zero-voltage vector, one of times to output a zero-voltage vector at a current cycle is set to zero and an amount of the one of the times is distributed to other of the times;
- a delay unit that delays the voltage vector output from the voltage-vector adjusting unit by the one control cycle, and outputs the voltage vector to the voltage-vector adjusting unit; and
- a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

6. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the

apparatus comprising:

- a voltage-vector control unit that determines, based on a voltage instruction value for the power converter, a voltage vector output from the power converter in one control cycle of the pulse-width-modulation control and a time to output the voltage vector;
- a voltage-vector adjusting unit that adjusts the time to output the voltage vector in such a manner that, upon receiving a voltage vector used for an adjustment in a previous control cycle and a time to output the voltage vector, when a total of a first time to output a zero-voltage vector lastly adjusted in the previous cycle and a second time to output a zero-voltage vector firstly in a current cycle is shorter than a predetermined time, the second time is adjusted to be a time obtained by subtracting the first time from the predetermined time;
- a delay unit that delays the voltage vector output from the voltage-vector adjusting unit by the one control cycle, and outputs the voltage vector to the voltage-vector adjusting unit; and
- a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

7. An apparatus for controlling a power converter in which an output voltage is controlled by a pulse-width-modulation control, the apparatus comprising:

- a voltage-vector control unit that determines, based on a

voltage instruction value for the power converter, a voltage vector output from the power converter in one control cycle of the pulse-width-modulation control and a time to output the voltage vector;

- a voltage-vector adjusting unit that adjusts the time to output the voltage vector, including a function of calculating an error accompanied by an adjustment of the time to output the voltage vector, in such a manner that, regarding a time to output a voltage vector obtained by correcting the voltage vector in a current cycle with the error calculated in a previous cycle,

- 10 when a time to output a zero-voltage vector is longer than a predetermined time, the time to output the zero-voltage vector is ensured at least for a constant time, and

- when the time to output the zero-voltage vector is shorter than the predetermined time, the time to output the zero-voltage vector is set to zero;

15 a delay unit that delays the voltage vector output from the voltage-vector adjusting unit by the one control cycle, and outputs the voltage vector to the voltage-vector adjusting unit; and

- a firing-pulse generating unit that generates a signal for turning on and off a semiconductor switching element included in the power converter based on the time to output the voltage vector adjusted by the voltage-vector adjusting unit.

8. The apparatus according to claim 1, wherein the voltage-vector adjusting unit adjusts the time to output the voltage vector in such a
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manner that the time to output the zero-voltage vector is ensured at least for the constant time without changing a relative ratio of output times of voltage vectors other than the zero-voltage vector.

- 5 9. The apparatus according to claim 2, wherein the voltage-vector adjusting unit adjusts time to output the voltage vector in such a manner that the time to output the zero-voltage vector is ensured at least for the constant time without changing a relative ratio of output times of voltage vectors other than the zero-voltage vector.

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10. The apparatus according to claim 7, wherein the voltage-vector adjusting unit adjusts time to output the voltage vector in such a manner that the time to output the zero-voltage vector is ensured at least for the constant time without changing a relative ratio of output times of voltage vectors other than the zero-voltage vector.
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11. The apparatus according to claim 2, wherein the voltage-vector adjusting unit adjusts the time to output the voltage vector in such a manner that, when the time to output the zero-voltage vector is set to zero, times to output voltage vectors other than the zero-voltage vector are set to longer than the constant time or set to zero, too.
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12. The apparatus according to claim 3, wherein the voltage-vector adjusting unit adjusts the time to output the voltage vector in such a manner that, when the time to output the zero-voltage vector is set to
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zero, times to output voltage vectors other than the zero-voltage vector are set to longer than the constant time or set to zero, too.

13. The apparatus according to claim 5, wherein the voltage-vector
5 adjusting unit adjusts the time to output the voltage vector in such a manner that, when the time to output the zero-voltage vector is set to zero, times to output voltage vectors other than the zero-voltage vector are set to longer than the constant time or set to zero, too.

10 14. The apparatus according to claim 7, wherein the voltage-vector adjusting unit adjusts the time to output the voltage vector in such a manner that, when the time to output the zero-voltage vector is set to zero, times to output voltage vectors other than the zero-voltage vector are set to longer than the constant time or set to zero, too.

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15. The apparatus according to claim 2, wherein, upon setting the time to output the zero-voltage vector set to zero, when the voltage vector lastly output in the previous cycle is different from the voltage vector firstly output in the current cycle, the voltage-vector adjusting
20 unit changes the voltage vector firstly output in the current cycle to the voltage vector lastly output in the previous cycle.

16. The apparatus according to claim 3, wherein, upon setting the time to output the zero-voltage vector set to zero, when the voltage
25 vector lastly output in the previous cycle is different from the voltage

vector firstly output in the current cycle, the voltage-vector adjusting unit changes the voltage vector firstly output in the current cycle to the voltage vector lastly output in the previous cycle.

- 5 17. The apparatus according to claim 5, wherein, upon setting the time to output the zero-voltage vector set to zero, when the voltage vector lastly output in the previous cycle is different from the voltage vector firstly output in the current cycle, the voltage-vector adjusting unit changes the voltage vector firstly output in the current cycle to the
10 voltage vector lastly output in the previous cycle.

18. The apparatus according to claim 7, wherein, upon setting the time to output the zero-voltage vector set to zero, when the voltage vector lastly output in the previous cycle is different from the voltage
15 vector firstly output in the current cycle, the voltage-vector adjusting unit changes the voltage vector firstly output in the current cycle to the voltage vector lastly output in the previous cycle.